12 An Eight-Year Evaluation of SMPY: What Was Learned?

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In 1971 the concept of systematic, annual mathematics talent searches was born because the number of talented students found through informal means was insufficient and because the staff of the Study of Mathematically Precocious Youth wanted to discover how many exceptionally mathematically able students there were within a given locale.

Six talent searches were conducted by SMPY from March, 1972, to January, 1979. The first search attracted participants chiefly from the greater Baltimore area, but the fourth one (December, 1976) extended over the Mid-Atlantic region. In 1979 the Johns Hopkins Office of Talent Identification and Development, now called the Center for the Advancement of Academically Talented Youth, was established to conduct the talent searches, seeking not only students with high mathematical ability but also those with high verbal and/or general ability. In 1980 Assistant Provost Robert N. Sawyer of Duke University adopted the SMPY model (Sawyer & Daggett 1982). Sanford J. Cohn also conducts an annual talent search from his center at Arizona State University at Tempe, as does Joyce Van Tassel-Baska of Northwestern University in Illinois. Many other efforts are based at least somewhat on the SMPY-CTY model. The concept of a talent search has spread and has been adopted across the country since 1972. In this way more than 85,000 students have been identified as talented. Currently, approximately 70,000 talented students are expected to be identified each year by the talent searches. This necessitates determining the validity and reliability of this identification protocol.

The goal of SMPY and of the programs conducting talent searches, however, is not only to identify talented students early but also to provide educational opportunities that make it more likely for these gifted students to become effective, productive adults. SMPY's model is an attempt to capitalize on Zuckerman's (1977) finding that accumulation of advantages characterized the backgrounds of Nobel Laureates in the United States.

Such advantages can be, or are for the most part, various educational opportunities. SMPY and the other programs try to provide these opportunities to their students. Accumulating educational advantage, SMPY predicts, will increase and enhance talented students' creative contributions as adults. This may be especially true if their education proceeds at a faster rate, since, based on Lehman's (1953) conclusion, an individual's greatest creative accomplishments tend to be concentrated within a few years when the scholar, scientist, or inventor is young.

Thus SMPY's model relies heavily on acceleration. The educational development procedures involve making the school curriculum flexible enough for intellectually talented students instead of developing new curricula (Stanley & Benbow 1982a, in press b). Furthermore, the staff of SMPY believes that offering intellectually talented students a varied assortment of accelerative possibilities and letting them choose an optimum combination of these to suit the individual's situation is far superior to so-called "special academic enrichment" (Stanley 1977).

Additional justification of acceleration was discussed by Robinson in this volume from the developmental psychological perspective. His central conclusion was that the pace of educational programs must be adapted to the capacities and knowledge of individual children. For a few students the appropriate fit involves placement several levels above the child's age-mates and is termed "radical acceleration." For others it may involve only moderate acceleration. The key point is that the curriculum is adapted so that each child can be learning at the level at which he or she is functioning. This is based on the premise that learning occurs only when there is "an appropriate match between the circumstances that a child encounters and the schemata that he has already assimilated into his repertoire" (Hunt 1961, p. 268). A class for high-IQ children could not possibly provide this match for every child.

Operating under its principle that SMPY should work with the school using its already available curricula or supplementing them with classes outside of school, SMPY formed special fast-paced mathematics classes that met on weekends or during summers and also encouraged its students to accelerate their education by skipping grades, taking college courses on the side while still a high-school student, entering college early, or taking Advanced Placement (AP) examinations for college credit. Although this procedure was flexible, it created some problems. For example, parents had to spend countless hours driving their children from high school to college, from junior high school to high school, or to summer or weekend classes; some children had to live double lives – as high-school student and as college student; a calculus course taken at an evening college may not be as beneficial as a calculus course taken in the day school of a university. Many other compromises are involved. Thus SMPY's smorgasbord of educationally accelerative opportunities (Benbow 1979; Stanley 1978a) should be viewed as a series of compromises between what may be ideal for a precocious child and the opportunities or circumstances that exist.

On a short-term basis the accelerative opportunities offered by SMPY were successful, as has been extensively documented (e.g., Stanley, Keating, & Fox 1974; Keating 1976; Stanley 1978c; Stanley & Benbow 1982b). A purpose of the research described in this volume was to discover how effective these compromises were over an eight-year period for the students who made them. Another goal was to characterize the students who participated in the talent searches. What has happened to the students identified by SMPY as being mathematically precocious? How many took SMPY's advice and accelerated their programs as they deemed best? In essence, the chapters in this volume provide the necessary data to be used in evaluating the long-term effectiveness of the SMPY model.

Most of the data for this evaluation were obtained from SMPY's first major follow-up of its students who had reached high-school graduation age (Benbow 1981). From 1972 to 1974 SMPY had identified over 2,000 students who as seventh- or eighth-graders had scored on the SAT-M or SAT-V as well as a random sample of high-school-junior or -senior females.

Identification Procedure

The first questions raised in this evaluation were these: How effective is SMPY's primary screening measure (i.e., the SAT)? What type of students are identified by looking for high scorers on the SAT in the seventh or eighth grade? The general conclusion was that SMPY's identification measure selects students in the seventh grade who achieve academically at a superior level in high school, especially in mathematics and science. The SAT-M score of an intellectually talented seventh- or eighth-grader has much predictive validity.

SAT-M scores, supplemented by SAT-V scores, are proving to be excellent in finding special talent in the area of mathematics. CTY showed how effective initially the SAT also is in the verbal areas. Long-term validity needs to be determined, however, for areas besides mathematics.

Certainly the SAT is not appropriate for everyone. SMPY and CTY work with extremely academically talented students who can demonstrate their precocity. In so doing, however, compromises have to be made. Some students, it was realized, are unable to demonstrate academic precocity because they lack facilitative environments and opportunity. Some are "late bloomers." Moreover, there are many types of giftedness. Obviously the SAT may tell little about leadership potential. Neither will the SAT be useful for identifying the moderately gifted in the seventh grade; it is too difficult. Thus use of the SAT in a talent-search protocol is appropriate only if it fits the goals of a particular program for gifted children. Where the aim is to provide better educational opportunities for students of demonstrably great academic aptitude, however, the SAT can be a highly effective identification instrument.

CREATIVITY

Much attention in the field of educating the gifted is focused on creativity. Moreover, SMPY's aim is to increase for many of its students the number of years during which their greatest creative contributions are made. Thus manifestation of creativity among the SMPY students was studied. Inconclusive and indecisive results were found by Michael in this volume, partly because of difficulty in defining creativity operationally. Moreover, it was hard to specify accomplishments in mathematics and science that by the end of high school should be considered creative. Consequently, it was found that questions in the follow-up survey were inadequate. The staff of SMPY is investigating this question further in its after-college follow-up and in the follow-up after high-school graduation of selected students from the last SMPY talent searches. Clearly, most of the SMPY students achieve well academically. When the SMPY students become about 50 years old, we shall know if for some of them their academic achievement is translated into creative achievement. The signs to date indicate that this will probably occur (see Stanley & Benbow 1982b, in press a).[1]

Educational Development

FAST-PACED CLASSES

The second set of questions concerns the educational facilitation procedures specified by the SMPY model, especially its fast-paced mathematics classes. What are the long-term effects of having attended one of these? Is educational acceleration of mathematically able youths justifiable? Do the facilitated students show a higher level of achievement? These issues were covered in chapters four through nine.

Findings from the eight-year follow-up of the participants in SMPY's first fast-paced precalculus classes and equally able nonparticipants revealed that the most successful students in the mathematics classes achieved much more in high school and college than the equally able students who had not participated. The students were satisfied with their acceleration, which they felt did not detract from their social and emotional development. Furthermore, there appeared to be no evidence to justify the fear that accelerated rate of learning produces gaps in knowledge or poor retention. Later, when the College Board's achievement tests were taken in high school, the accelerated students had not scored lower on those exams than the nonaccelerated students. Even though the accelerated students had gone to college at an earlier age, this was not at the expense of the quality of the institution they attended, as was judged by the Astin (1965) ratings. Thus learning mathematics at an accelerated rate appears to have had distinctly beneficial effects.

The rate at which mathematics is taught by SMPY's methods depends upon the student. In the first fast-paced classes, it was taught at a pace geared to the ablest members in the class. This approach necessitated splitting up the classes into a faster and a slower section, because some students could not keep up with the initial rate of instruction. This early approach to teaching mathematics has been altered from experience. Students are no longer taught as a class, which involves lecturing and group participation. Instead, SMPY and CTY utilize the Diagnostic Testing followed by Prescriptive Instruction (DT → PI) model (Stanley 1978b, 1979). Through diagnostic testing the student's placement in mathematics is determined. Moreover, testing allows the instructor to determine what the student knows and does not know about precalculus. The student then learns, at his/her individual rate, only the subject matter not known. Progress is certified by use of standardized tests. Thus instruction has become quite individualized, accommodating a wide range of students from the moderately gifted to the highly gifted. The initial success of the new approach has been documented (Bartkovich & Mezynski 1981). The long-term effects remain to be evaluated but are not expected to be less positive than the results from the evaluation of the first fast-paced mathematics classes.

SMPY's accelerated classes have not been limited to the domain of precalculus. They have been conducted successfully in calculus (Mezynski & Stanley 1980; Mezynski, McCoart, & Stanley, in this volume) and also in college chemistry and physics (Mezynski, McCoart, & Stanley, in this volume). During the summer of 1982 fast-paced high-school biology and chemistry were taught to extremely academically able students in three weeks each. At the end of the three weeks the class's mean score on the College Board's biology achievement test was 730 (the ninety-sixth percentile of a select group of students who had taken one or more years of high-school biology) and 743 on the chemistry achievement test (the ninety-fourth percentile of the norm group). Initially the fast-paced classes have been highly successful. Students have received a solid background in the subject matter of these classes. The long-term effects remain to be evaluated, however. SMPY will do so.

Mathematics and the sciences are subjects more dependent for their mastery on manifest intellectual talent than on chronological age and associated life experiences. The Program for Verbally Gifted Youth (PVGY) in CTY at Johns Hopkins, however, adapted the fast-paced approach for teaching courses in the verbal area (Durden 1980). In its writing skills courses PVGY helps students achieve the following: (1) an expository writing style that is both accurate and imaginative; (2) knowledge of the syntactical possibilities of English and naturalness of diction; (3) understanding and appreciation of the semantic, structural, and rhetorical resources of the English language; and (4) basic library and research skills. The staff of PVGY also offers courses such as German, Latin, Etymology, and Critical Readings in Literature. These classes are offered during the academic year and during the summer in a residential setting. Initial results are very positive, but longitudinal evaluation of PVGY's programs remains to be done.[2]

SEX DIFFERENCES

Although the fast-paced model of instruction is effective and has lasting impact, it may be that the mathematics and science classes are more appropriate for 11- to 14-year-old boys than for girls that age. Many mathematically talented girls seem to have different needs from most mathematically talented boys. This lack of suitability may be a major component in determining the sex difference in mathematics achievement among SMPY students. It is well known that many females prefer to work with people rather than with things. This is reflected in their evaluative attitude profiles (Allport, Vernon, & Lindzey 1970). Furthermore, females show more interest in and positive feelings toward others (Oetzel 1966) and generally rate higher on nurturance and affiliation items (Kelly 1979). In 1973 such findings led to the first program run by SMPY that catered especially to girls (Fox 1976). This was an accelerated algebra program for an all-female class that emphasized social elements. The teachers were female; problems were solved cooperatively rather than via the common independent and competitive approach; problems were rewritten to be more appealing to girls; and several role models were brought in to show by example how careers in fields using mathematics can be appropriate and enjoyable for girls. The major goal of the program was to increase the number of years of mathematics taken in high school and college by these girls. This in turn should have made it more likely for the girls to enter careers with a quantitative emphasis. Although the program was successful in recruiting moderately gifted girls to attend, the long-term effects appeared small as judged from the evaluation by Fox, Benbow, and Perkins in this volume. Apparently the social and academic elements of the program were not strong enough or were not continued long enough for girls of the ability levels involved.

Perhaps the short duration of the program was a critical factor. Two months of effort after the seventh grade may be insufficient to have long-lasting impact. Perhaps encouragement and attention are needed throughout the high school years; this hypothesis follows because girls perceive themselves as being less independent than boys and exhibit less confidence in their abilities (Maccoby & Jacklin 1974; Pedro et al. 1981). Moreover, women tend to attribute their success to luck or chance while men attribute their success to their abilities. Clearly, with such outlooks, girls need more encouragement and attention than their male counterparts if they are to succeed. This may be especially true before precedents are made for girls to enter quantitatively oriented fields. Modified replications of Fox's experiment with abler girls are needed.

ENTERING COLLEGE EARLY

Fast-paced classes are only one accelerative option offered to students in the talent searches. Skipping grades and thereby entering college early, perhaps also with advanced standing, is another. The justification for this approach, discussed by Robinson in this volume, has already been summarized in this chapter. Is this approach effective, however? Does educational acceleration harm students' social and emotional development? In chapters eight and nine the results of the evaluation of SMPY's use of educational acceleration are presented. The late Professor Halbert B. Robinson of the University of Washington discussed the success of "radical accelerants" (i.e., students who have skipped several grades) in his and SMPY's programs. The introductory chapter also provides clues to the later success of radical accelerants, as do Stanley and Benbow (1982b, in press a). In general, the radical accelerants experience academic success without encountering much other difficulty. The early signs of creativity in this group are being detected as some of these students begin publishing their research articles.

Opposition to acceleration of gifted students is justified primarily by concern for the possible effects of acceleration on social and emotional development. Previous research on this topic was compiled and published in an earlier volume of this series (George, Cohn, & Stanley 1979). The main emphasis of that volume was to compare acceleration and enrichment approaches to facilitating the education of gifted students. Yet Keating (1979, p. 218) in that volume concluded that "as for the social-emotional concerns, it seems time to abandon them unless and until some solid reliable evidence is forthcoming that indicates real dangers in well-run programs." The results of the studies reported by Daggett and Robinson in this volume support that conclusion. Neither Daggett nor Robinson found any detrimental effects of acceleration among radical accelerants; nor did the accelerated students voice any detrimental effects (Benbow, in this volume).

Although acceleration can be appropriate for many gifted students, it is not for all. John F. Feldhusen (in this volume) makes that point quite clearly when he argues that one must be eclectic when setting up programs for gifted students. Acceleration and *selective* enrichment are vital elements of any program. This was the main conclusion of the earlier volume (George, Cohn, & Stanley 1979). Feldhusen carefully delineates guidelines for when acceleration and enrichment are appropriate and provides working examples for the professional interested in the subject. His key point, however, is that the best programs for the gifted embody both acceleration and enrichment.

Adaptability of the Programs

A major desirable feature of a program is its transportability. No matter how effective a new program is, if it cannot be adapted or duplicated in another setting, its impact is diminished. John Lunny and Joyce Van Tassel-Baska, both in this volume, provide useful evidence, and so do Sawyer and Daggett (1982). The talent-search model and its associated educational programs can be adapted, cost-effectively, in a variety of settings.

To date the success of SMPY students has been remarkable. This may lead one to wonder if the success of the students is not due entirely to the programs but instead in some measure to "halo effect." Although we doubt that this is true, even if it was, this should not be considered detrimental. If telling students that they have great academic potential will help produce the results SMPY has experienced, telling them should be encouraged. It is virtually certain, however, that without the SMPY and CTY special programs the students could not have achieved nearly as much as they have to date. For example, without the program few would have been able to enter college early. Colleges would not have accepted them.

Stronger, long-term tests of SMPY's effectiveness will come when the talent-search students reach their professional midlives, about age 50. Then we should be able to judge the effects of SMPY's procedures better. From now until at least then the staff of SMPY will attempt to monitor the students' progress with questionnaires at important points.

In this book we have examined the validity of SMPY's identification and educational facilitation procedures by means of longitudinal research. These principles, practices, and techniques were shown to be effective and transportable to various settings. If there is a special lesson to be learned thus far, it is that curricular flexibility, augmented by special fast-paced courses, can work wonders for young, able, highly motivated students. Educational systems should provide those precious ingredients.

Notes

1. One need not wait until SMPY's protégés reach midlife in order to find evidence of their creativity. A number have already been the author or coauthor of an original contribution to the professional literature, e.g., Chien in O'Rourke et al. (1982) at age 15, Camerer (1977) at age 16, and Stark at age 23 in a forthcoming issue of the *Journal of the Association of Computing Machinery* and previously, at age 16 (Stark & Stanley 1978).

2. During the summer of 1983 there was a total of more than 1,000 9–16-year-old registrants in CTY's two three-week residential programs on each of two college campuses. All of these young students, who came from across the country, had scored in the top 1 percent of their age group verbally or mathematically.

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